

Graduate Major in Chemistry

【Doctoral Degree Program】

1. Outline

The purpose of the program is to train young talents to have a broad knowledge of both fundamental and specialized issues related to materials, to encourage them to become leaders of a specialized field related to Chemistry and to contribute natural science and applied fields.

2. Competencies Developed

We focus on the academic development of the following competencies:

- Have a broad and deep knowledge of Chemistry related topics, and can utilize this knowledge to approach new chemical problems
- Lead research at the frontiers of chemical sciences with a strong sense of responsibility and ethics
- Integrate the results of various fields related to materials research from a chemistry point of view, and actively use this knowledge
- Demonstrate international leadership in the field of study

3. Learning Goals

The curriculum will help to develop these competencies using the following approaches:

A) Study advanced challenges

Using the specialized skills from the master program, identifies new, important scientific problems and able to solve them

B) Able to integrate different fields of knowledge and organize them into new systems

C) Achieve international leadership in the study fields

4. IGP Completion Requirements

The following requirements must be met to complete the Doctoral Degree Program of this major.

1. A total of 24 credits or more acquired from 600-level courses.
2. From the courses specified in the Graduate Major in Chemistry curriculum,
 - 12 credits acquired from Research Seminars in Chemistry
 - 1 credit acquired from Advanced Exercise in Chemistry
 - a minimum of 18 credits acquired from Core Courses of the Graduate Major in Chemistry

- a minimum of 6 credits acquired from Liberal Arts and Basic Science Courses

(2 credits from the 600-level Humanities and Social Science Courses, and 4 credits from Career Development Courses).

3. At least one paper published in a good peer-reviewed journal in the subject of the doctoral thesis. As a general rule, the student should be the first author. A paper accepted for publication is considered to be equivalent to published papers.

4. Pass the doctoral thesis review and defense.

Table D1. Graduate Major in Chemistry Completion Requirements

Course category		<Required courses> Required credits	<Electives> Minimum credits required	Minimum credits required	Associated learning goals	Comments
Liberal arts and basic science courses	Humanities and social science courses		2 credits	6 credits	B	
	Career development courses		4 credits		B, C	
	Other courses					
Core courses	Research seminars	Seminar in Chemistry S3 Seminar in Chemistry F3 Seminar in Chemistry S4 Seminar in Chemistry F4 Seminar in Chemistry S5 Seminar in Chemistry F5 A total of 12 credits, 2 credits each from the above courses.		18 credits	A, B	
	Research-related courses				A, B	
	Major courses	Advanced Exercise in Chemistry, 1 credit			A, B, C	
Total required credits		A minimum of 24 credits in addition to meeting the above conditions				
Note		• Japanese Language and Culture Courses offered to International Students can be recognized as Humanities and Social Science Courses of the corresponding course level. • As for Liberal Arts and Basic Science Courses, please refer to the relevant pages.				

5. IGP Courses

Table D1 summarizes the core course categories and the credit requirements for graduation in the doctoral program (listed by categories and subjects). The columns on the right show the associated learning goals. Identify carefully the relationship of the learning goals and the subjects.

Table D2 shows the courses of specialized subjects in the doctor program. Courses with a name of other Graduate Major listed in the comments columns are those of Core Courses in that Graduate Major and once one of these courses is taken, it has been referred to that in the Graduate Major in Chemistry, according to the course category.

Table D2. Core Courses of the Graduate Major in Chemistry

Course category		Course Number	Course		Required credits	Competencies	Learning goals	Comments	
Research seminars	600 level	CHM.Z691.R	◎		Seminar in Chemistry S3	0-2-0	1,2,3,4	A,B	
		CHM.Z692.R	◎		Seminar in Chemistry F3	0-2-0	1,2,3,4	A,B	
		CHM.Z693.R	◎		Seminar in Chemistry S4	0-2-0	1,2,3,4	A,B	
		CHM.Z694.R	◎		Seminar in Chemistry F4	0-2-0	1,2,3,4	A,B	
		CHM.Z695.R	◎		Seminar in Chemistry S5	0-2-0	1,2,3,4	A,B	
		CHM.Z696.R	◎		Seminar in Chemistry F5	0-2-0	1,2,3,4	A,B	
Major courses	600 level	CHM.A641.L		E	Colloquium on Advanced Chemistry I	1-0-0	1,3	A,B,C	
		CHM.A642.L		E	Colloquium on Advanced Chemistry II	1-0-0	1,3	A,B,C	
		CHM.A643.L		O	Colloquium on Advanced Chemistry III	1-0-0	1,3	A,B,C	
		CHM.A644.L		O	Colloquium on Advanced Chemistry IV	1-0-0	1,3	A,B,C	
		CHM.A651.L			Laboratory Training of Advanced Chemistry I	0-0-1	1,2,3,4,5	C	
		CHM.A652.L			Laboratory Training of Advanced Chemistry II	0-0-1	1,2,3,4,5	C	
		CHM.A653.L			Laboratory Training of Advanced Chemistry III	0-0-1	1,2,3,4,5	C	
		CHM.A654.L			Laboratory Training of Advanced Chemistry IV	0-0-1	1,2,3,4,5	C	
		CHM.A661.L		★	Basic Exercises in Global Presentation	0-1-0	1,2,3	C	

		CHM.A662.L	★	Advanced Exercises in Global Presentation	0-1-0	1,2,3,5	C	
		CHM.L670.R	◎	Advanced Exercise in Chemistry	0-1-0	2,3,4,5	A,B, C	
		CHM.L671.L		Advanced Laboratory Work in Chemistry I	0-0-1	1,2,3,4,5	A,B	
		CHM.L672.L		Advanced Laboratory Work in Chemistry II	0-0-1	1,2,3,4,5	A,B	
		CHM.L673.L		Advanced Laboratory Work in Chemistry III	0-0-1	1,2,3,4,5	A,B	
		CHM.L674.L		Advanced Laboratory Work in Chemistry IV	0-0-1	1,2,3,4,5	A,B	
		CHM.L675.L		Advanced Laboratory Work in Chemistry V	0-0-1	1,2,3,4,5	A,B	
		CHM.L676.L		Advanced Laboratory Work in Chemistry VI	0-0-1	1,2,3,4,5	A,B	

Note :

•◎ : Required course, ○ : Restricted elective, ★: Classes in English O : odd academic years, E : even academic years

• Competencies: 1 = Intercultural skills; 2 = Communication skills; 3 = Specialist skills; 4 = Critical thinking skills;

5 = Practical and/or problem-solving skills•

• The character preceding the three digits in the course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ABC.D400.R). A: Basic Chemistry, B: Inorganic/Analytical Chemistry, C: Physical Chemistry D: Organic Chemistry, Z: Research Seminars

6. IGP Courses That Can be Recognized as Humanities and Social Science Courses

None

7. IGP Courses That Can be Recognized as Career Development Courses

For the completion of this doctoral program, career development courses of Liberal Arts and Basic Science Courses should also be taken. In principle, the Graduate Attribute (GA) shown in Table A-1 or Table A-2 (refer to the “Guide to Graduate Education and International Graduate Program (Liberal Arts and Basic Science Courses) - Career Development Courses”) all must be taken and it is necessary to acquire four or more credits in satisfying the GA. The status of GA acquired is judged in the course at the time of completion. Several major courses in the Academic Leader Program (ALP) and the Productive Leader Program (PLP) can be taken as career development courses, as listed in Table B-1 and B-2, respectively. It has to be noted that the credit of these courses cannot be regarded as those required for major courses once they are taken as career development courses.

Table B-1. Courses of the Graduate Major in Chemistry that can be recognized as Career Development Courses in the Academic Leader Program (ALP)

Course category	Course number	Course		Credits	GA*	Learning goals	Comments
Major Courses that can be recognized as Career Development Courses	XIP.A601		★	Advanced International Practice in Science	0-2-0	A1D	Common Course of School of Science <u>Outside</u> the Graduate Major in Chemistry standard curriculum
	CHM.A651.L			Laboratory Training of Advanced Chemistry I	0-0-1	A2D, A3D	C
	CHM.A652.L			Laboratory Training of Advanced Chemistry II	0-0-1	A2D, A3D	C
	CHM.A653.L			Laboratory Training of Advanced Chemistry III	0-0-1	A2D, A3D	C
	CHM.A654.L			Laboratory Training of Advanced Chemistry IV	0-0-1	A2D, A3D	C
	CHM.A661.L		★	Basic Exercises in Global Presentation	0-1-0	A1D, A2D	C
	CHM.A662.L		★	Advanced Exercises in Global Presentation)	0-1-0	A2D, A3D	C
<p>★: Classes in English</p> <p>To satisfy the Career Development Courses requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).</p> <p>* GA: Graduate Attribute</p>							

Table B-2. Courses of the Graduate Major in Chemistry that can be recognized as Career Development Courses in the Productive Leader Program (PLP)

Course category	Course number	Course		Credits	GA*	Learning goals	Comments
Major Courses that can be recognized as Career Development Courses	XIP.A601		★	Advanced International Practice in Science	0-2-0	P1D	Common Course of School of Science <u>Outside</u> the Graduate Major in Chemistry standard curriculum

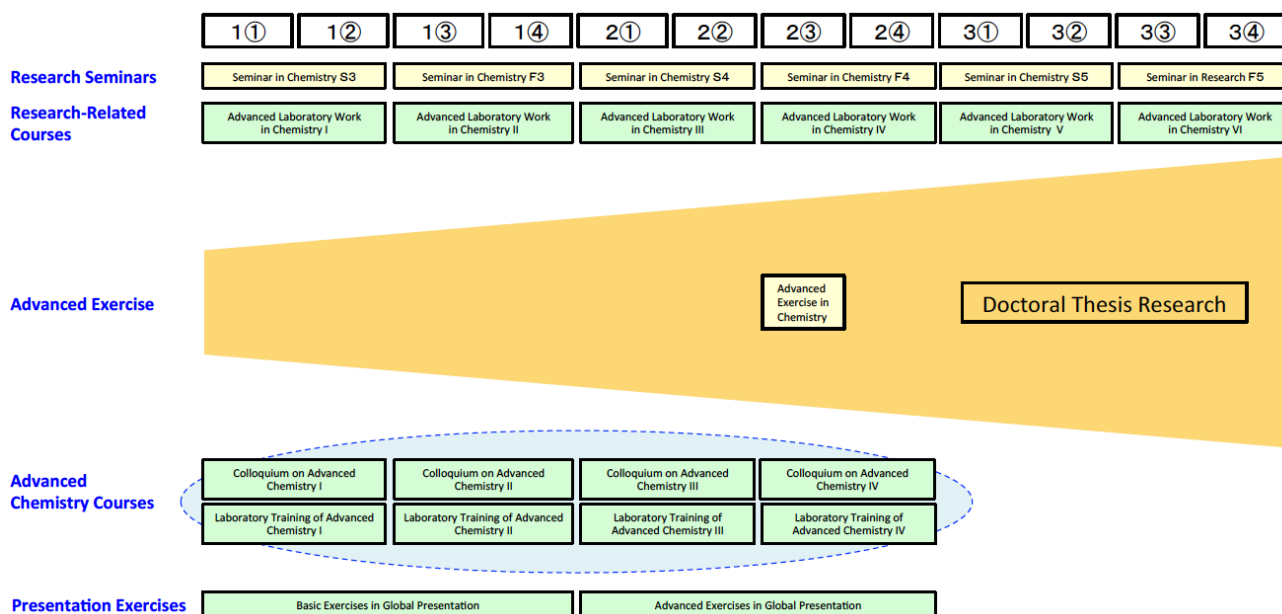
	CHM.A651.L		Laboratory Training of Advanced Chemistry I	0-0-1	P2D, P3D	C	
	CHM.A652.L		Laboratory Training of Advanced Chemistry II	0-0-1	P2D, P3D	C	
	CHM.A653.L		Laboratory Training of Advanced Chemistry III	0-0-1	P2D, P3D	C	
	CHM.A654.L		Laboratory Training of Advanced Chemistry IV	0-0-1	P2D, P3D	C	
	CHM.A661.L	★	Basic Exercises in Global Presentation	0-1-0	P1D, P2D	C	
	CHM.A662.L	★	Advanced Exercises in Global Presentation)	0-1-0	P2D, P3D	C	

★: Classes in English

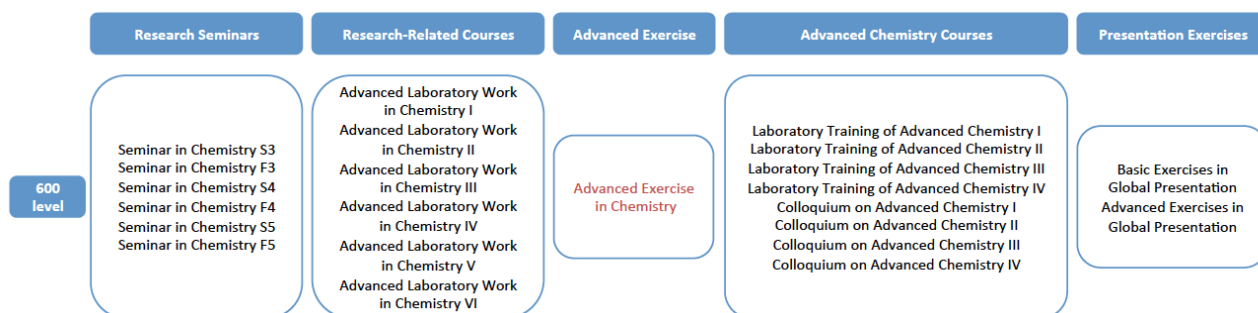
To satisfy the Career Development Courses requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

*** GA: Graduate Attribute**

8. Overview of Curriculum System

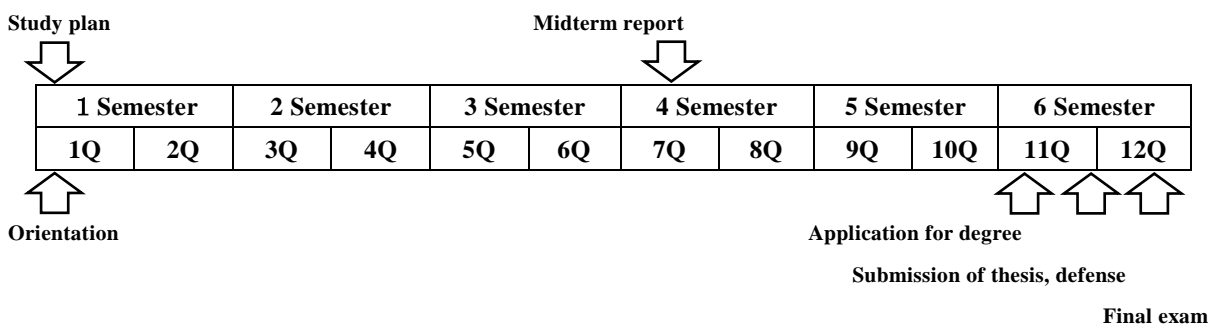


9. Example of a Standard Curriculum



10. Research Related to the Completion of Doctoral Theses

Through the doctoral thesis research, the candidate should discover new problem of significant importance in international scientific enterprise, and develop the abilities for pointing out the issues to be solved, analyzing the situations, and proposing the solution. At the same time, communication skills are also gained to publish the results nationally and internationally. The doctoral thesis, the thesis presentation and the final exam are based on the compilation of these achievements.



The criteria for examination

Following requirements must be met for the qualification:

1. The thesis should be original and is confirmed to be the world level of research which would contribute to the development of the academic field of chemistry.
2. The subject of the doctoral thesis should be published as at least one paper in a good peer-reviewed journal. As a general rule, the student should be the first author. A paper accepted for publication is considered to be equivalent to published papers.